

Task Order 14-10

1.0 TITLE OF EFFORT: International Space Station Safety and Mission Assurance

2.0 TASK DESCRIPTION:

The contractor provides S&MA support, and management for, the coordination and integration of International Space Station (ISS) Safety and Mission Assurance (S&MA) tasks. These tasks assure definition and implementation of appropriate safety, reliability, maintainability, and quality programs. At a minimum, these tasks include: performing analyses, assessments, reviews, and evaluations; preparing and presenting reports and briefings; monitoring and evaluating ISS on-orbit operations in near-real-time as a part of the Mission Evaluation Room (MER) team; and participating in Program meetings.

2.1 SOW REFERENCE: Section C, Subsections 5.0

2.2 REQUIREMENTS

The contractor provides S&MA support, and management for, the coordination and integration of International Space Station (ISS) Safety and Mission Assurance (S&MA) tasks. These tasks assure definition and implementation of appropriate safety, reliability, maintainability, and quality programs. At a minimum, these tasks include: performing analyses, assessments, reviews, and evaluations; preparing and presenting reports and briefings; monitoring and evaluating ISS on-orbit operations in near-real-time as a part of the Mission Evaluation Room (MER) team; and participating in Program meetings.

2.2.1. Safety

2.2.1.1. Integration

- a. Support the S&MA flight readiness review process by: identifying and raising all concerns or known or potential constraints or exceptions to endorsement; providing technical evaluation of selected topics; presenting such evaluations to senior S&MA management as required; collecting, preserving, and providing, as requested, evidence of S&MA endorsement completion; and participating in S&MA readiness review processes to identify potential topics of discussion.
- b. In support of annual Program Operating Plan (POP) development, provide a Budget Requirements and Basis of Estimate document which includes current Government fiscal year budgeted Equivalent Person (EP) levels for each task in this task order and forecasted EP requirements for each task for next five Government fiscal years. Basis of estimates for the next fiscal year shall include the following data:
 - i. detailed description of the task or identification of applicable work instructions where the details are contained;
 - ii. inputs required with identification of external sources and expected volume;
 - iii. output products generated;
 - iv. schedule/timeliness expectations;
 - v. costing assumptions, including contractor-owned cost drivers such as processing time, review time, and skill mix;
 - vi. EP requirements for each task, including calculations;
 - vii. conversion of EP requirements to dollar requirements for each fiscal year;
 - viii. comparison of current year budget and forecasted requirements with identification and explanation of changes;
 - ix. qualitative description of technical risk associated with not performing the task;
 - x. explanation of Certification of Flight Readiness (COFR) applicability and impact;
 - xi. Contractor recommended changes to the SOW or this task order;

Basis of Estimate for out year projections shall include qualitative rationale for EP estimates for each task. Multiple iterations of BOE's may be required as a part of budget negotiation process.

- c. In support of NASA requirements for management and quality metrics, the contractor shall propose, develop, provide, and maintain selected metrics for administration of NE resources, assessment of ISS S&MA processes, assessment of the ISS program, and other objectives as required by the Chief of the ISS Division and directed within the scope of this Task Order by the COTR.

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- d. Support the JSC S&MA and ISS risk management processes by: identifying and assessing technical and programmatic risks; documenting risks in the applicable risk system; developing recommended and alternative risk mitigation strategies; presenting risk summaries and mitigation plans to the Program; and conducting and reporting on technical risk trade studies involving S&MA risk factors.

Deliverables

- a. Flight Readiness Reports will be provided in accordance with established Directorate processes for ISS S&MA Panel, Safety and Mission Success Reviews (SMSRs) and JSC Center Director Readiness Reviews.
- b. Program Operating Plan (POP) Requirements report containing the described Basis of Estimate. Updated as changes occur.
- c. Other management products including, but not limited to, metric reports, risk reports and trade studies

Schedule Requirements

Schedule for delivery of management products are indicated below:

- a. Flight Readiness Reports will be provided in accordance with established Directorate processes for ISS S&MA Panel, Safety and Mission Success Reviews (SMSRs) and JSC Center Director Readiness Reviews.
- b. Final POP requirements report shall be provided not later than 30 calendar days before the end of the performance period.

2.2.1.2. Vehicle

- a. Provide ISS subsystems expertise to include the following knowledge and skills: knowledge of system and component design and architecture; knowledge of system and component test and verification methods and results; knowledge of system and component interfaces and interdependencies; knowledge of system and component operational procedures and limits; and the ability to apply such knowledge of systems and components to the evaluation of S&MA analyses and other products as described elsewhere in this section.
- b. Provide Systems Requirement Review, Preliminary Design Review, Critical Design Review, Technical Interchange Meeting, and Acceptance Review support in the following areas: S&MA assessment of hardware/system designs and data packages, including non-JSC Government Furnished Equipment; Review Item Discrepancy (RID) submissions; representation at the review and disposition of S&MA-related RID's; RID tracking and resolution; and reporting of review activities and decisions. As required, review component and system test plans and support selected test events.
- c. Perform S&MA evaluations of program changes for impact to requirements, performance and cost. Provide evaluation, copies of formal change evaluations, and disposition recommendation to NASA. Represent issues and S&MA impacts at Program Technical Coordination Meetings.
- d. As a member of the System Problem Resolution Teams (SPRT) representing S&MA, Subsystem engineers will perform assessments of Problem Report and corrective Action (PRACA) Analysis to primarily identify potential impacts to on orbit safety, reliability and mission success. Subsystem engineers will also ensure level of significance, recurrence controls, and corrective actions are adequately documented in the PRACA.
- e. Contractor S&MA engineers shall: (1) Represent S&MA at selected Program reviews and meetings, and provide meeting notes to selected S&MA community members summarizing the results of the meeting. (2) Provide playbooks for ISS Program meetings which contain the expected meeting agenda, S&MA contact and assessment of each agenda item, copies of formal change evaluations, and an S&MA disposition recommendation for each agenda item. (3) Provide S&MA engineering support to selected ISS S&MA meetings, including coordination pre-meetings to brief the S&MA representative on the content of the playbook.
- f. Perform S&MA Subsystem assessments of ISS Hazard Analysis to ensure that all the hazards have been identified, causes listed, and controls are in place and verified, and provide results to the Safety Review Panel (SRP). Perform an S&MA Evaluation for all Safety Noncompliance Reports (NCR's) which

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provide an assessment of the acceptability of the risk which will be incurred if the NCR is accepted, and a recommendation as to whether S&MA should concur on the acceptance of the NCR.

- g. Perform S&MA Subsystem assessment of FMEA/CILs to ensure that all the failure modes have been identified. Provide results to the R&M Panel/R&M Working Group. Perform a S&MA Evaluation for all CILs which provide an assessment of the acceptability of the CIL rationale for acceptance and a recommendation as to whether S&MA should concur on the acceptance for the CIL.

Deliverables

- a. Review Item Discrepancies (RIDs) or similar milestone review documents
- b. Program Change Request evaluations and recommendations on designated evaluation forms
- c. Program Change Request cost evaluations and tracking matrix
- d. S&MA evaluations of each PRACA report including a completed S&MA checklist. When necessary, root cause analysis and/or fault tree analysis.
- e. Playbooks for ISS Program meetings.

Schedule Requirements

Schedule for delivery of management products are indicated below:

- a. Due dates or deadlines for RID submission will be defined for each milestone review.
- b. Due dates or deadlines for Program Change Evaluation submission will be established by ISS Configuration Management Office for each CR released.
- c. Periodic review of Program Change Evaluation cost matrix
- d. Due dates and deadlines for PRACA evaluations will be identified separately.
- e. Deadlines for initial Playbook submittal will be defined by the assigned S&MA Control Board representative. Final playbooks shall be delivered not later than 1 hour prior to the start of the meeting.

2.2.1.3. Software

- a. Perform a safety assessment of software milestone reviews. Verify that the requirements matrix for each Computer Software Configuration Item (CSCI) traces SSP 50038 requirements to the PIDS, the Software Requirements Specification and to the Test Cases. Research open SCRs/SPNs to verify incorporation of Severity 1 problems in the planned build content and test cases. Review CSCI submittals to assure that the packages are complete, open work has been completed and any safety concerns have been addressed. Assess Data Assessment Report (DAR) submittals to verify that all SSP 50038 requirements have been satisfied and that any non-compliances have been accurately documented and accepted by the Program. Maintain a schedule of software milestone activities as derived from an assessment of Schedule Issue Forms. Assess SIF for impact to milestone review schedule, impact of changes and/or deletion of required software milestone reviews. Provide vehicle engineering software support to the Software Product Delivery Review (SPDR) and at Software Acceptance Review including CSCI submittal reviews to assure that package is complete and that all open work has been completed. Communicate software milestone review assessment results, issues and recommendations to CSWG, ISS SW Safety Lead and the ISS S&MA Avionics & Software Lead. Coordinate and consolidate results with SQA.
- b. Perform a safety assessment of contractor/IP provided Computer Based Control System (CBCS) compliance matrices. Review CBCS matrix to assess plans for showing that software complies with SSP 50038 requirements. Assess Verification Compliance Notice (VCN) submittals to verify that all SSP 50038 requirements have been satisfied and that any non-compliances have been accurately documented and accepted by the Program. Communicate CBCS/VCN assessment results, issues and recommendations to the CSWG and the ISS SW Safety Lead and the ISS S&MA Avionics & Software Lead.
- c. Perform a safety audit of Boeing recommendations for Hazardous Command List (HCL), Restricted Command List (RCL) and Critical Command List (CCL) in accordance with the NASA approved process. Ensure that all commands are correctly classified. Coordinate discrepancies with MOD/Boeing Safety. Perform assessment of Scratch generated commands to verify that commands conform to SSP 50038 safety requirements. Communicate command assessment results, issues and recommendations to the CSWG and the ISS SW Safety Lead and the ISS S&MA Avionics & Software Lead.

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- d. Perform a safety assessment of Uplink Configuration Requirements Document (UCRD). Ensure inclusion and implementation of all elements required by Safety. Communicate UCRD assessment results, issues and recommendations to the ASCB S&MA Rep, SQP and the ISS SW Safety Lead and the ISS S&MA Avionics & Software Lead.
- e. Perform safety assessment of Station Program Notice (SPN). Assess the recommended user response to the problem to verify that situation presented by the problem has been adequately addressed, that the correct steps for its resolution are specified, ensuring the workaround does not compromise safety, and that all safety aspects have been considered. Represent S&MA at SPN Team meetings. Bring final Severity 1 SPN before the CSWG. Communicate SPN assessment results, issues and recommendations to the CSWG and the ISS SW Safety Lead and the ISS S&MA Avionics & Software Lead.
- f. Perform a safety assessment of software-related Space Station Change Requests (SSCN). Review Changes for new capability and its impact to hazard reports and SSP 50038 safety requirements. Review Changes for impact to S&MA review schedule. Assess changes in required reviews (PDR, etc.) and review data submittals for compliance with software safety assessment needs. Communicate SSCN assessment results, issues and recommendations concerning SSCN and schedule impacts to the ISS SW Safety Lead, the Avionics & Software Control Board (ASCB) safety representative and the ISS S&MA Avionics & Software Lead.
- g. Provide assurance that the developer is reviewing Software Change Requests (SCRs) for safety impacts. Provide assurance that these impacts are documented in PVCS and that sufficient rationale is provided for the recommendation. Provide an evaluation of the recommended severity and rationale including concurrence or non-concurrence and counter-proposal if needed. Provide the assurance evaluations to the NASA S&MA Representative to the JSRP and the NASA SW Safety Lead. Develop and provide metrics indicating the quality of the reviews provided by the developer.
- h. Provide a safety assessment of MOD Safety Related Core Timeliner Scripts. Review Timeliner scripts to ensure that the scripts correctly implement SSP 50038 safety requirements and conform to Safety/MOD agreements on the use and implementation of Hazardous Commands as documented in SSP 50645, Appendix F. Communicate Core Timeliner Script assessment results, issues and recommendations to the CSWG, the ISS SW Safety Lead and the ISS S&MA Avionics & Software Lead.
- i. Provide Avionics Software Control Board (ASCB) Playbook for the ASCB Agenda review and evaluation for safety impacts. Provide Change Review (CR), Software Change Request (SCR), Schedule Impact Forms (SIFs) and other Safety topic evaluations to the ISS S&MA Software Assurance representative to the ASCB. Provides triage of non-assessed SCRs and assessment of Open Paper in support of CoFR (STRR and SORR). Maintain records of ASCB results and of Changes approved at the ASCB. Maintain quality records of Open Paper assessments for STRR, SORR and CoFR. Communicate Open paper assessment results, issues and recommendations concerning Open paper to the ISS SW Safety Lead, and the ISS S&MA Avionics & Software Lead.
- j. Conduct onsite SQA audits of Space-X and Orbital UCM efforts as defined, for the visiting Vehicles. Program Implementation Audit and Final Program Audit.
- k. Support CEV software audits in conjunction with the CEV GFE Software audits and reviews as established by the CEV Program Schedule. (Atlas, ICCA and CEV milestones are covered by CEV GFE tasking)

Deliverables

- a. Requirements tracking matrix
- b. Review Item Discrepancies
 - Technical Design assessment
 - Test Readiness assessment
 - Timeliner documentation and process.
- c. Milestone schedule
- d. Content assessment
- e. Software Product Delivery Review recommendation
- f. Software Acceptance Review Board recommendation
- g. Acceptance Data Package recommendation
- h. Data Delivery Review assessment/recommendation
- i. Presentation material for CSWG
- j. SCR safety assurance assessment and metrics

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- k. Station Program Note (SPN) assessment
- l. Severity 1/1N SPN coordination
- m. Assessments of HCL, CCL, RCL, and Command from Scratch
- n. Computer Based Control System Compliance Matrix assessment & recommendation
- o. Verification Compliance Notice (VCN) assessment & recommendation
- p. Space Station Change Notice assessment/recommendation
- q. Schedule Impact assessment
- r. ASCB Playbook
- s. Software Transition Readiness Review briefing
- t. Stage Operational Readiness Review briefing
- u. Software assurance meeting agendas, minutes, actions, and schedules
- v. Timeliner Script assessment
- w. SQA Audit Reports

Schedule Requirements

- a. All software evaluations shall be completed prior to the applicable Software Transition Readiness Review (STRR) or Stage Operations Readiness Review (SORR).
- b. S&MA milestone review schedules shall be updated and distributed weekly as a minimum.

2.2.1.4. Operations

- a. Perform real-time safety and mission success assurance assessments in the Mission Evaluation Room in accordance with SSP 50437 and JSC 36431 to ensure hazard controls and safety requirements are properly implemented. Investigate hardware/software anomalies, CHITs, or changes in operations for potential new risks to crew or vehicle operations. Additional work required outside of shifts for Anomaly Resolution Teams (ART) and Flight Investigation Teams (FIT), preparation of safety and risk assessments, preparation of mission data books, and to document process improvements. Provide assessments, analysis results, and recommendations to MER Manager, ARTs, and the S&MA Mission Management Team Representative. Provide periodic reports to S&MA community and management.
- b. Perform integrated S&MA analyses of Contractor Furnished Equipment (CFE), Government Furnished Equipment (GFE), Payloads, Extravehicular Activity (EVA), Extravehicular Robotics (EVR), Visiting Vehicle and International Partner/Participant (IP/P) related operational concepts and anomalies.
- c. Prepare and present pre/post-flight reviews. Provide vehicle hardware and software status to S&MA Flight and Stage Reviews.
- d. Verify the incorporation of Operations controls by evaluating the Operations Control Agreement Document (OCAD), the CIL Ops Matrix, the Station Program Note (SPN) matrix, against the Flight Rules and Operations Procedures. Mitigate safety inconsistencies with appropriate organizations or POC's. Track and report verification work performed, and maintain CoFR compliance evidence. Provide a closed loop verification of category 1 SPNs implemented via Flight Rules and Ops Procedures.
- e. Evaluate operations documents to ensure hazard controls and CIL workarounds are properly incorporated and new hazards are not created, including: Flight Rules; Emergency, Malfunction, and Corrective Action Procedures; Safety of Flight (SoF) changes to baselined U.S. and IP procedures and Operations Data File (ODF) management documents; Maintain tracking of changes and evaluations. Represent S&MA at Systems Operation Data File Control Board (SODFCB) and alternate representative at the multi-lateral ODF Control Board.
- f. Perform evaluations and provide recommendations and Discrepancy Notices (DNs) to the Flight Operations Reviews (FOR) and Increment Operations Review (IOR) and Ops Boards. Perform assessments and provide recommendations at the Joint Operations Panels (JOP). Includes Contingency Shuttle Crew Support (CSCS) JOP activity.
- g. Establish, maintain and evaluate S&MA Operations requirements in Program documentation such as the Station Program Implementation Plans (SPIP) and Bilateral Agreements Documents for Program and IPs. Conduct S&MA Ops Technical Interchange Meetings (TIMs) with MSFC and IP organizations. Evaluate operations related program change request. Provide status and special briefings to the S&MA Panel.
- h. Generate Review Item Discrepancies as required of Logistics Support Analysis Records (LSARs) maintenance procedures for Removal and Replacement (R&R) of ORUs, Station Operations Data Files

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(SODFs), LSAR Sustaining Process (LSP) sheets, Technical Data & Documentation (TD&D), which includes Illustrated Parts Breakdown (IPB) and Source Data & Documentation (SD&D). Evaluate core maintenance procedures, technical data, and source data for safety, incorporation of maintainability data, validity, and accuracy. This includes verifying that maintenance procedures call for the proper tools/parts and are written in a manner which prevents/minimizes any hazardous conditions. Resulting maintenance procedures are used by MOD for crew training. Provide input to the Integrated Logistics Support Management Team. Participate in weekly LE Technical Interchange Meetings (TIM), LE Boiler Room Meetings, and periodic LSAR reviews. Resolve specific action items.

- i. Support the Logistics Engineering Operations Working Group and Maintenance and Resupply (M&R) Team to ensure that safety is not compromised in the planning or implementation of maintenance activities. Resolve, coordinate, and track the resolution of assigned actions. Annex 1 to the Increment Definition and Requirements Document (IDRD), establishes the ISS detailed launch and return manifest for each flight. Annex 2 to the IDRD is a coordination medium for on-orbit maintenance and resupply processes. L&M evaluates all Annex 1 & 2 Change Requests for Safety concerns and reviews for technical content. Evaluation of CSRD in support of MER Ops. Provide Safety and technical assessments to ensure required spares, available tools, and support equipment to perform on-orbit required maintenance are in place, and requirements for CoFR Endorsement E are satisfied.
- j. Provide Safety Observations and Variances (SOVAR) report in accordance with the appropriate work instruction.

Deliverables

- a. MER Safety Console shift reports, status reports, engineering analyses and assessments, fault tree analyses, CHIT responses, and technical presentations.
- b. Pre-flight and Post-flight data packages.
- c. Operational Controls Verification Matrix, STRR Checklist Ops inputs, CoFR Checklist Ops inputs
- d. Evaluations, assessments, Discrepancy Notices (DNs), and analyses of flight products and other vehicle and operational documentation.
- e. Agendas, protocols, meeting minutes, and other documentation associated with Ops TIMs.
- f. Observations Log, safety analyses of observations, records of SOVAR disposition.
- g. Comments/RIDs for LSAR and TD&D product reviews forwarded to the OB5 Vehicle Office representative.

Schedule Requirements

Schedule for delivery of management products are indicated below:

- a. MER Console products are due as specified in SSP 50437.
- b. Pre-flight packages are due to the NE Operations Lead and IMMT Rep not later than 7 calendar days prior to launch. Post-flight review packages are due to the Operations Lead and IMMT Rep not later than 30 calendar days after landing.
- c. Due dates and deadlines for ops controls matrices, STRR checklists, and CoFR checklists will be established on a review-by-review basis.
- d. Due dates and deadlines for evaluations of operations products will be identified.
- e. Due dates and deadlines for TIM products will be identified.
- f. SOVAR's are dispositioned in accordance with the work instruction.
- g. Delivered in accordance with due dates defined for the specific review.

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2.2.2 Reliability and Maintainability

- a. Assess HW Providers Limited Life Item (LLI) and Preventative Maintenance Assessments (PMA) at the piece part level, in accordance with agreed to work instruction, utilizing the GOLD, MADS, VMDB, GFE Cert Database as required.
- b. Assess if manifested hardware should have an LLI completed as defined by JPD315. This assessment is not expected to determine correctness of LLI but is to verify the required assessment has been completed by the data provider. Hardware that is 'not-first-flight' hardware, CHeCS, Flight Crew Equipment (FCE), Payloads, EVA, and other Government Furnished Equipment (GFE) shall be excluded from the LLI assessment.
- c. Assure the hardware provider's Preventative Maintenance Assessment (PMA) meets with R&M Panel approval. Hardware that is 'not-first-flight' hardware, CHeCS, Flight Crew Equipment (FCE), Payloads, EVA, and other Government Furnished Equipment (GFE) shall be excluded from the PMA assessment.
- d. Evaluate the International Partner (IP) HW providers LLI/PMA products at the element level excluding re-flight hardware.
- e. Evaluate HW Manifested on visiting vehicle for LLI/PMA excluding re-flight hardware.

Deliverables

- a. LLI/PM Analysis CoFR Product provided to the NASA NE R&M Lead prior to each ISS Flight.

Schedule Requirements

- a. Assessment of PMA must be approved by the R&M Panel Chair no later than 30 calendar days prior to launch or 3 weeks prior to the SMARR, whichever occurs first.

3.0 PERIOD OF PERFORMANCE: October 1, 2009 – April 30, 2010

4.0 ESTIMATED COSTS:

Contractor may provide travel, training, materials, and other non-labor resources as necessary to support task order requirements. Training may include selected professional discipline-based or spaceflight-based conferences with approval of the TMR."